



United States  
Department of  
Agriculture



Forest Service

Forest Pest  
Management

Davis, CA

Fourth Report

# NATIONAL STEERING COMMITTEE FOR MANAGEMENT OF WESTERN DEFOLIATORS

FPM 92-1  
OCTOBER 29, 1991

Pesticides used improperly can be injurious to human beings, animals, and plants. Follow the directions and heed all precautions on labels. Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides where there is danger of drift when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment, if specified on the label.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

**NOTE:** Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Environmental Protection Agency, consult your local forest pathologist, county agriculture agent, or State extension specialist to be sure the intended use is still registered.



FPM 92-1  
OCTOBER 29, 1991

FOURTH REPORT

NATIONAL STEERING COMMITTEE FOR  
MANAGEMENT OF  
WESTERN DEFOLIATORS

Prepared by:

John W. Barry  
Chairperson

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USDA Forest Service  
Forest Pest Management  
2121C, Second Street  
Davis, CA 95616  
(916) 758-4600

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FOURTH REPORT

National Steering Committee for  
Management of  
Western Defoliators

October 29, 1991

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USDA Forest Service  
Washington Office/Forest Pest Management  
2121 C 2nd Street  
Davis, CA 95616  
(916)758-4600  
FTS 460-1715

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on use of viruses in British Columbia in 1991  
to control Douglas-fir tussock moth.

## I. INTRODUCTION

The fourth meeting of the National Steering Committee for Management of Western Defoliators met at Corvallis, Oregon, July 23-24, 1991. The primary purpose of the meeting was to identify national needs for managing western defoliators.

### A. Attendees

Roy Beckwith <sup>2</sup> .	PNW/FIDR (Corvallis, OR)
Dayle Bennett <sup>1</sup> .	R-3/FPM (Albuquerque, NM)
J. Robert Bridges <sup>1</sup> .	WO/FIDR (Washington, DC)
Jesus Cota	WO/FPM (Washington, DC)
John Cunningham <sup>1</sup> .	Forest Pest Management Institute (Sault Ste. Marie, Ontario)
Gary Daterman	PNW/FIDR (Corvallis, OR)
Kees van Frankenhuyzen <sup>1</sup> .	Forest Pest Management Institute (Sault Ste. Marie, Ontario)
Dave Grimble <sup>2</sup> .	PNW/FIDR (Corvallis, OR)
Jim Hadfield <sup>1</sup> .	R-6(RO)FPM (Portland, OR)
Tom Hofacker	WO/FPM (Washington, DC)
Bruce Hostetler	R-6(RO)FPM (Portland, OR)
Ladd Livingston	Idaho Department of Lands (Coeur d'Alene, ID)
Dave Overhulser <sup>2</sup> .	Oregon Department of Forestry (Salem, OR)
Dave Rising	MTDC (Missoula, MT)
Terry Rogers <sup>2</sup> .	R-3(RO)FPM (Albuquerque, NM)
Pat Shea	PSW/FIDR (Davis, CA)
Larry Stipe	R-1(RO)TM (Missoula, MT)
Julie Weatherby	R-4(BFO)FPM (Boise, ID)
John Wenz	R-5(RO)FPM (San Francisco, CA)
Jack Barry (Chairperson)	WO/FPM (Davis, CA)

1. Committee Member Absent

2. Non-member

## B. Committee Purpose

The purpose of this committee is to identify national needs for managing defoliators of western forests. Management, within the context of the committee, includes direct control with biological and chemical insecticides, cultural control, population monitoring, survey methodology, risk/hazard rating, and damage/impact assessment. Identified needs were ranked in order of priority as voted by the committee members. A separate category of recommendations that covers administrative issues is included in the report. The report is submitted to the Director, Forest Pest Management, Washington, DC.

With the expanded scope of the committee, sub-committees will henceforth be needed to develop recommendations on certain needs and issues. Four sub-committees as listed in paragraph II, C were appointed at the Corvallis meeting. A letter of instruction will be sent by the Chairperson to each sub-committee that delineates its charge and product delivery schedule. The majority of needs identified by this committee are candidates for WO/FPM technology development funding. Other sources of funding should be pursued to address needs identified by this committee. The call letter for technology development proposals was sent to FPM field offices by Director, Forest Pest Management on September 16, 1991 with responding proposals due by November 15, 1991.

## C. Reports to the Committee

The following members submitted written reports that are enclosed in the Appendix A:

Dayle Bennett	R-3
Gary Daterman	PNW
Bruce Hostetler	R-6
Ladd Livingston	State of Idaho
Pat Shea	PSW
Larry Stipe	R-1
Julie Weatherby	R-4
John Wenz	R-5

## II. CURRENT NATIONAL NEEDS/RECOMMENDATIONS

### A. National Needs

These are listed in order of priority with number 1 being the highest priority; and subdivisions, e.g. 6a and 6b, having equal priority.

1. Develop a strategic plan to identify existing data and to obtain data on impact of B.t./viruses on non-target organisms.
2. Develop an improved formulation carrier for operational use of TM Biocontrol-1 that is easier to handle in the field.
3. Determine impact on timber resources of western spruce budworm in treated and untreated areas.

4. Summarize and evaluate existing knowledge and develop silvicultural prescriptions for management of defoliators.
5. Adapt eastern U.S. and/or develop techniques for detection and population monitoring of gypsy moth in the West.
6.
  - a. Evaluate off-target movement of pesticides from treatment blocks.
  - b. Evaluate need for/develop as necessary DFTM early warning pheromone survey monitoring system with action thresholds adjusted for geographical variation in response.
7.
  - a. Identify, evaluate, and recommend guidance and tracking systems for spray aircraft.
  - b. Evaluate performance of existing and new atomizers for ULV application.
  - c. Evaluate pheromone disruption against WSBW.
  - d. Extend DFTM hazard/risk rating system for northern Idaho to other geographic areas.
8.
  - a. Develop pheromone monitoring system for WSBW and other western defoliators.
  - b. Identify lowest effective dose of Dimilin against DFTM.
  - c. Evaluate tip borer impact and risk rating in plantations and young stands especially ponderosa pine.

#### B. Recommendations

1. Develop an interdisciplinary strategic plan that recommends approaches to deal with defoliator pest interactions and impacts on non-timber and timber resources. This recommendation is consistent with and supportive of current interest in uneven-aged management, new perspectives, and forest health initiatives.
2. Support the screening development testing and technology transfer of biologicals, semiochemicals, allelochemicals, and pheromones for management of forest defoliators.
3. Increase western representation on the National Steering Committee for Application of Pesticides - Gypsy Moth and Eastern Defoliators. (Note Dave Bridgwater (recently appointed) and Steve Munson represent the West on the gypsy moth committee).
4. Request from FPM Director R-6 and NA the 5-year plan that the virus Product Coordinators, Jim Hadfield and Dick Reardon have been asked to prepare.



## C. Sub-Committees and Other Actions

### 1. Appointment of Sub-Committees

#### a. Sub-Committee for Registered Pesticides for Western Defoliators

Chairperson - Julie Weatherby  
Members - Roy Beckwith  
Jim Hadfield

#### b. Sub-committee for Impact of Biological Insecticides on Non-target Organisms

Chairperson - Canadian to be named  
Members - Dave Grimble  
Dayle Bennett

#### c. Sub-committee for Strategic Forest Health Plan for Western Defoliators

Chairperson - John Wenz  
Members - Bruce Hostetler  
Ladd Livingston

#### d. Sub-committee for developing a 5-year plan that identifies major needs that are to be accomplished progressively to improve FS ability to manage the western spruce budworm and Douglas-fir tussock moth.

Chairperson - Gary Daterman  
Members - John Wenz  
Bill Antrobus (subject to supervisor's approval)

2. Dave Grimble is the PNW focal/coordination point for information on impact of B.t. on non-target organisms. John Wenz in coordination with Dave will explore interests with Canadians in sponsoring a workshop on non-target issues related to biological insecticides. John Wenz will sponsor a seminar on this topic at the ~~1992~~ <sup>1993</sup> Western Forest Insect Work Conference.

3. The committee suggested that its scope include tip and shoot insect; however, the Seed, Cone, and Regeneration Steering Committee claimed this category at its June 1991 meeting.

4. Concern was expressed that state cooperators are not receiving FPM reports.

5. The reference Aerial Insecticide Projects for Suppression of Western Defoliators 1970 - 1989 has been updated with 1990 project listings and was distributed by WO/FPM (Davis) in September 1991.
6. PSW has asked FPM to cooperate with them in technology transfer of the expert system INSEX.
7. The committee desires that this committee continue to report on status of past recommendations.
8. Region 3, as reported by Terry Rogers, has been treating trees in campgrounds infested with western spruce budworm using ground sprayers in the Rio Grande drainages. Region 3 is requested to write-up the procedures for sharing with the other Regions.
9. Gary Daterman will coordinate pursuing the Browne technique for bioassay of B.t.
10. Bob DeBoo reported (Memorandum dated August 22, 1991 enclosed in the Appendix) that British Columbia used virus tank mixes, formulated with molasses, to treat Douglas-fir tussock moth. B.t. was also used in 1991 to treat gypsy moth.

#### D. Microbials and Forestry - A Marketing Perspective

Temple Bowen gave a presentation on the above referenced topic at the North American Forest Insect Work Conference on March 27, 1991. His talk was directed to the issues, needs, and challenges faced by industry in marketing biological insecticides in forestry. It assigns no fault - simply states the facts. I encourage you to read Temple's paper that he shares with us. It is enclosed in Appendix B.

### III. STATUS OF PREVIOUS RECOMMENDATIONS

Following are recommendations made by the committee in 1991 and their current status:

#### A. Laboratory and/or Investigations

1. Pursue laboratory testing of new Bacillus thuringiensis (B.t.) strains.

Roy Beckwith and Dave Grimble have been conducting in 1991 laboratory tests of the Mycogen "encapsulated" B.t. strains at Corvallis FSL. This effort is partially funded by FPM Technical Development Projects. Roy and Dave will be incorporating additional commercial product(s) from the Bac-Tec company in the near future. These evaluations will continue in FY 1992.

2. Develop a plan to obtain data on impact of B.t. on non-target organisms.

No work progress on this area of study in 1991; however a study plan/proposal is being prepared by Dave Grimble and Roy Beckwith with Dave as lead investigator. The effort could develop into a partnership effort involving cooperators from FPM, Oregon State University, and the EPA. A source of funding will be necessary to support this research.

3. Explore techniques for rapid bioassay of B.t.

(See Pat Shea's report in Appendix A)

4. Develop, identify, and evaluate improved carriers for TM Biocontrol-1.

There is a clear need for improved carrier for the TM Biocontrol-1 virus that has been stockpiled for treatment of DFTM populations. The feed-grade molasses listed on the label has handling problems making molasses difficult to use on operational projects. The Espro company's powdered substitute represents an improvement, but additional development work is required. Evaluations of totally different substrates should be sought as well. Roy Beckwith has discussed the problem with Dick Reardon (NA), and they have considered opportunities to combine forces for evaluations of potential materials. Jim Hadfield and Dick Reardon, product coordinators for TM Biocontrol-1 and Gypchek respectively, have been asked by the WO to coordinate a 5-year plan for the development evaluation and testing of the virus formulations. The plan has not been prepared. Airport testing of molasses carrier and Espro's RTU carrier were field tested at Davis, CA in January 1991. This was followed-up by atomization studies in the University of California wind tunnel.

5. Determine evaporation rates and physical properties of microbial tank mixes.

Bob Ekblad, MTDC has negotiated agreements with the U.S. Army and the Spray Drift Task Force (a consortium of industry members) to cooperate in determining evaporation rates of pesticide formulations. An MOU has been signed by the FS and Spray Drift Task Force whereby the latter provides \$100,000.00 and the former provides for the work to be done under the U.S. Army contract. Additionally, we are pursuing under terms of a separate contract, and in cooperation with the U.S. Army, a computer model that predicts evaporation of multiple component tank mixes.

## B. Field Tests

1. Field test TM Biocontrol-1 including lower doses, and with improved carriers as they become available. Priority is given to testing methods of controlling Douglas-fir Tussock Moth (DFTM) as the insect is in current outbreak.

A field test of DFTM virus for dosage adjustments was field-tested in R4 (near Featherville, Idaho) by Roy Beckwith, Dave Grimble, and Julie Weatherby. The spray applications were successfully completed the second week of July. The original plan called for 4-treatments, namely a zero check, the standard "label" dosage, 1/2-label amount, and 1/4-label amount. Due to difficulty in finding a sufficient number of acceptable plots, the 1/4-dose level was dropped.

2. Conduct mating disruption tests using pheromones against western spruce budworm.

No activity on this subject in 1991. Substantial funding would be required to effectively evaluate this approach to western spruce budworm population suppression.

3. Conduct cooperative field tests of several dosages (0.5, 1, and 2 ounces per acre) of Dimilin against DFTM and study non-target effects compared to non-target effects of B.t.

No work on this in 1991.

## C. Pilot Projects and Cooperative Field Tests/Pilot Projects

1. Conduct cooperative pilot test of TM Biocontrol-1, double (spring and summer treatments) against new, low level, and sub-outbreaks of DFTM.

No work on this in 1991.

2. Conduct mating disruption tests using pheromones against DFTM.

A cooperative pilot test to suppress populations of DFTM was conducted in southern Idaho in 1991. Treatment application July/August. Lonne Sower and Julie Weatherby conducted this test. Last report was that the study was going nicely, with good populations of insects on all plots. Funding is by FPM Technical Development Projects.

3. Conduct cooperative field tests/pilot tests of new strains of B.t. against western spruce budworm as they are recommended by PNW (Project 4502).

No new strain recommendations in 1991.

4. Conduct pilot test of B.t. against new and low level outbreaks of DFTM.

No work on this in 1991.

5. Conduct pilot test of Dipel 8L and Dipel 8AF applied at 32 ounces per acre to control western spruce budworm.

This was suggested to Abbott Lab. but they did not pursue supporting this recommendation in 1990 nor in 1991.

#### D. Equipment, Models, and Technology Development

1. Evaluate the utility of the computer model Computer Assisted Spray Productivity Routine (CASPR) on a pilot or operational project.

Field evaluations of CASPR were conducted in 1991 by WO/FPM (Davis) through its contractor CDI and in cooperation with R-4 and the State of Utah. Draft report was delivered early September 1991.

2. Evaluate existing aircraft guidance systems and provide recommendations for operational deployment.

MTDC has submitted a draft project proposal for FPM funding.

3. Evaluate and recommend methods of sampling ultra low volume (ULV) sprays on pilot and operational projects.

This need continues but no action for its pursuit.

4. Update and add spray nozzle specification data to the Program WIND aerial application equipment handbook.

No work on this in 1991.

5. Coordinate complex terrain modeling with Global Positioning System (GPS), Geographic Information Systems (GIS), and expert system activities being developed by the FS.

MTDC has submitted a draft project proposal for FPM funding.

#### E. Information and Administrative Management

1. Plan and conduct multi-year monitoring, analyses, and data management of spray treatments.

Opportunities to understand the multi-year economic, biological, and environmental short and long-term effects of activities to manage western defoliators exist but are not being pursued.

There appears to be more emphasis on next year's treatment than in quantitating the economics, cost benefits, and environmental impact of past management activities.

Since World War II the Bureau of Entomology and Plant Quarantine and the Forest Service have treated millions of acres in the West. The literature, however, is wanting in reports of studies that assess the post-treatment (greater than one year after treatment) effects. Post-treatment analyses could have significant importance to nearly all activities involving western defoliators. If we had five years of post-treatment data, for example, of western spruce budworm that told us how much growth was saved, and what the impact may have been on non-targeted species, we would be in a far better position to argue for or against a particular management strategy. Such data would also be invaluable in developing prediction models.

The Western Regions have this need and concern e.g. R-6 has multi-year data from some of their past treatment blocks, R-2 has western spruce budworm mortality data, R-3 is studying volume loss from Red River Canyon and has a 5-year data-base from the Jemez Mountain (1977) project.

A significant potential for collection of these types of data exists in the West, with the appropriate cooperative approach between FIDR and FPM. Results of these efforts could drastically alter our approach to management of western defoliators.

#### F. Other Related 1991 Activities at PNW

1. Pheromone-baited traps for monitoring DFTM populations. Apparently 1990 results by users of this system were good, as we have heard no concerns this year about their predictive capabilities. Lonnie Sower is working with Phero Tech to come up with a trap and lure combination that will duplicate what the Forest Service has been providing, or that can be calibrated to serve the same purpose. The objective of this study is to transfer supply of these monitoring materials to the private sector.
2. Pheromone-baited traps for monitoring western spruce budworm. Chris Niwa is now lead scientist in PNW for developing and validating this system. She succeeds Charles Sartwell who retired in September 1990. The objective of this cooperative study is to develop an operational monitoring system that will predict degrees of defoliation.
3. Pheromone-baited traps for monitoring spruce budworm in Alaska. For the second year, Skeeter Werner is using baited traps to monitor C. fumiferana in interior Alaska. To our knowledge there is no operational development objective at this time.

4. Phytochemicals as feeding stimulants and deterrents for defoliators. Rick Kelsey is continuing his promising work on identification and evaluation of secondary plant compounds as materials that will modify pest acceptance of host plants.
5. Long-term population-monitoring of DFTM and western spruce budworm. Dick Mason and Torgie Torgersen have been pursuing this work for many years. The sampling methods and population data from different stands and areas are valuable as baseline data that ultimately will relate to risk assessment and hazard rating of forest conditions. Bruce Hostetler has established long-term impact plots which overlay some of Torgersen's budworm population plots.

#### IV. SUMMARY

The National Steering Committee for Management of Western Defoliators met at Corvallis, Oregon, July 23-24, 1991. The primary purpose of the meeting was to identify national needs for managing western defoliators and to report these needs to the Director, Forest Pest Management. Needs were identified, listed by priority, and submitted to WO for funding considerations. Other recommendations are provided in this report for management consideration. Four sub-committees were appointed with the charge to develop plans and recommendations related to managing western defoliators. The next meeting of the committee will be hosted by the Southwest Region and is tentatively scheduled for Albuquerque, NM, August 20-21, 1992.

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## APPENDICES

- A. Committee Member's Reports
- B. A Marketing Perspective - Temple Bowen
- C. Bob DeBoo Memorandum



**APPENDIX A**

## SUMMARY OF A SURVEY TO DETERMINE EFFECTS OF BT ON NONTARGET MOTHS

In response to concerns raised during an environmental analysis of a western spruce budworm outbreak on the Camino Real Ranger District, Carson National Forest, the New Mexico Zone of Forest Pest Management began a multi-year survey to obtain information concerning the effects of B.t. on nontarget moths within and adjacent to areas of potential treatment. Specific concerns were that an aerial application of B.t. could potentially cause a significant and possibly adverse impact on the primary food base (moths) of flammulated owls, a state listed sensitive species for New Mexico, during the critical nesting period of mid-May through mid-July.

The objectives of this multi-year survey are to:

A. Determine diversity (genera) and relative abundance of moths within areas of potential aerial applications of B.t. on the Camino Real Ranger District (Rio Pueblo Canyon, La Junta Canyon, and U.S. Hill) and within similar areas where B.t. will not be applied (Rio Pueblo Canyon, La Junta Canyon or possibly Rio Grande del Rancho Canyon), 1991.

B. Monitor the effects of B.t. on nontarget moth populations during the year of proposed B.t. application, 1992.

C. Monitor the longterm effects of B.t. on nontarget moth populations for one to three years following B.t. application or until affected nontarget moth populations have returned to pretreatment levels.

The primary purpose of sampling in 1991 was to obtain baseline information on the moth populations and to develop and refine our survey techniques (light trapping). A battery-powered (12-volt) black light insect collector fitted with a photo-sensitive cell was placed at each of eight different sample locations (four within areas proposed for aerial application of B.t. and four within similar areas not proposed for aerial application of B.t.). These traps were simultaneously operated twice weekly (Monday night and Friday night) between sunset and sunrise from June 12 through July 12.

Traps were cleaned each morning following black light operation (Tuesday and Friday mornings). Specimens collected from each trap were boxed, labelled by individual traps, then stored in a freezer. We plan to process these collections this winter by preparing several mounts of representative moths, sorting and counting the moths collected by trap and date of collection, and having an identification made (to genus and species where possible) of representative moths. All microlepidopterans will be lumped into one category as they are not considered a part of the owls food base.

Statistical tests will be performed on the following hypotheses:

- Ho: Moth densities are not statistically different between sample locations (potential treatment and nontreatment areas), 1991.
- Ho: Species diversity (representative moth genera) are not statistically different between sample location (potential treatment and nontreatment areas), 1991.

Postscript: Recent egg mass surveys indicate the WSB population in the study area has dropped to a level below which an aerial application of B.t. in 1992 is warranted. Therefore, this study will not be continued in FY 92. It could, however, be resumed in the near future when WSB populations again reach levels that may warrant aerial applications of B.t.

## WESTERN DEFOLIATOR STEERING COMMITTEE MEETING

July 23-24, 1991

G.Daterman, PNW Research Station

## FOLLOW-UP ON RECOMMENDATIONS FROM NOVEMBER 1990 MEETING

1. Pursue laboratory testing of new BT strains/products: Roy Beckwith and Dave Grimble have been conducting laboratory tests of Mycogen, Inc. "encapsulated" BT strains at Corvallis FSL in 1991. This effort is partially funded by FPM Technical Development Projects. Roy and Dave will be incorporating additional commercial product(s) from the Bac-Tec company in the near future. These evaluations will continue in FY 1992.
2. Obtain data on impacts of BT on non-target organisms: No work progress on this area of study in 1991. However, a study plan/proposal is being prepared by Dave Grimble and Roy Beckwith with Dave as lead investigator. The effort could develop into a partnership effort involving cooperators from FPM, Oregon State University, and the EPA. A source of funding will be necessary to support this research.
3. Develop improved carriers for DFTM virus spray formulations: There is a clear need for improved carrier for the TM BioControl-1 virus that has been stockpiled for treatment of DFTM populations. The feed-grade molasses listed on the label simply has too many handling problems for use on an operational scale. The Espro company's powdered substitute represents an improvement, but even in that case additional development work is required to determine if lesser quantities would be adequate. Evaluations of totally different substrates should be sought as well. No work on this has been accomplished in 1991. Beckwith has discussed the problem with Dick Reardon (NE Area), and they have considered opportunities to combine forces for evaluations of potential materials.
4. Field testing of DFTM virus for dosage adjustments: A dosage test of the DFTM virus is being field-tested in R<sup>4</sup> (near Featherville, Idaho) by Roy Beckwith, Dave Grimble, and Julie Weatherby. The spray applications were successfully completed the 2nd week of July, and evaluation of efficacy is now underway. The original plan called for 4-treatments, namely a zero check, the standard "label" dosage, 1/2-label amount, and 1/4-label amount. Due to difficulty in finding a sufficient number of acceptable plots, the 1/4-dose level was dropped.
5. Mating disruption of western spruce budworm with synthetic pheromone: No activity on this subject in 1991. Substantial funding would be required to effectively evaluate this approach to budworm population suppression.

6. Cooperative pilot/field-test of DFTM virus with spring and summer treatments against low-density populations: There were no efforts on this approach in 1991.

7. Pilot test of mating disruption with synthetic pheromones for DFTM: A cooperative pilot test to suppress populations of DFTM will be conducted in southern Idaho in 1991. Treatment application will be in late July or early August. Lonne Sower and Julie Weatherby are conducting this test. Last report was that study plan implementation was going nicely, with good populations of insects on all plots. Funding is by FPM Technical Development Projects.

8. Conduct cooperative pilot/field-tests of new strains of BT as recommended by PNW: No 1991 activities on this item.

#### OTHER RELATED 1991 ACTIVITIES IN PNW

1. Pheromone-baited traps for monitoring DFTM populations: Apparently 1990 results by users of this system were good, as we have heard no concerns this year about their predictive capabilities. Lonne Sower is working with Phero Tech to come up with a trap and lure combination that will duplicate what the Forest Service has been providing, or, that can be calibrated to serve the same purpose. The objective of this study is to transfer supply of these monitoring materials to the private sector.

2. Pheromone-baited traps for monitoring western spruce budworm: Chris Niwa is now lead scientist in PNW for developing and validating this system. She succeeds Charles Sartwell who retired in September 1990. The objective of this cooperative study is to develop an operational monitoring system that will predict degrees of defoliation.

3. Pheromone-baited traps for monitoring spruce budworm in Alaska: For the second year, Skeeter Werner is using baited traps to monitor C. fumiferana in interior Alaska. To our knowledge there is no operational development objective at this time.

4. Phytochemicals as feeding stimulants and deterrents for defoliators: Rick Kelsey is continuing his promising work on identification and evaluation of secondary plant compounds as materials that will modify pest acceptance of host plants.

5. Long-term population-monitoring of DFTM and western spruce budworm: Dick Mason and Torgie Torgerson have continued this work for many years. The sampling methods and population data from different stands and areas are valuable as baseline data information, that ultimately relates to risk assessment and hazard rating of forest conditions.

## 1991 DOUGLAS-FIR TUSSOCK MOTH SUPPRESSION PROJECT, WALLOWA-WHITMAN NF

LOCATION: Pine Ranger District, Wallowa-Whitman NF, Oregon.

INSECTICIDE: Thuricide 48LV applied undiluted at 16 BIU in 42.7 oz per acre.

APPLICATION: Equipment was 2 UH1B helicopters with Beecomist nozzles, 2 Bell Solos with Micronair nozzles, and 2 Air Tractors with Micronair nozzles. Contractor was Altair Inc.

ACRES TREATED: 116,064

ESTIMATED COST: \$1,800,000

DISCUSSION: Insecticide application began on July 4 and completed on July 25. The project area is located in northeastern Oregon on the Pine Ranger District of the Wallowa-Whitman NF. Originally the project area included about 165,000 acres, but was reduced to 110,000 acres after cocoon sampling in the spring indicated that DFTM populations were at low levels on about 50,000 acres. The project area is characterized by terrain from rolling hills to steep canyons. Elevations range from 3,500 to almost 7,000 feet.

To qualify for treatment an analysis unit was required to have a population level of at least 2 cocoons per 1000 sq. in. of midcrown foliage.

Weather was characterized by an abnormally cool spring. Thus, insect development was 3 to 4 weeks behind normal. This delayed the time at which DFTM larval development was optimal for treatment (i.e., at least 70% of DFTM larvae in 2nd instar or later).

Western spruce budworms were also causing visible defoliation in much of the project area. Both DFTM and WSB larvae were counted in pre- and post-treatment samples. Post-treatment samples were collected 21 days after treatment, but have not been analyzed as yet.

1991 SPRAY TRIALS  
DIPEL 6AF

LOCATION: Yuba City Airport, California.

INSECTICIDE: Dipel 6AF (Bacillus thuringiensis) undiluted at 1/3 gal/acre.

APPLICATION: Bell 47G with Beecomist nozzles.  
Turbo Thrush with Micronair AU 5000 nozzles.  
Turbo Thrush with Beecomist nozzles.

DISCUSSION: The objective of the spray trials was to observe the handling characteristics of Dipel 6AF applied with conventional helicopter and fixed-wing spraying systems. An additional interest was to observe the operational use of Swathkit.

Recommendations are that the new formulation of Dipel 6AF should be considered for operational use. The material handled as well as any of the aqueous formulations of B.t. used to date. The vmd of the material was determined to be well within the appropriate range.

Time spent reading and analyzing spray deposit cards was greatly reduced using Swathkit. It is also an excellent system to use for gathering meteorological data for use in analyzing the card line data.

1991 SPRAY TRIALS  
TM-BIOCONTROL-1 AND GYPCHEK

LOCATION: Davis, California.

INSECTICIDES: TM-Biocontrol-1 (DFTM virus)  
Gypchek (gypsy moth virus)

APPLICATION: Hiller 12E with Beecomist nozzles.  
Ag Cat Super Biplane with Micronair nozzles.

DISCUSSION: Trials were conducted to determine if the new carrier formulations for the viruses would operate in conventional aircraft spraying systems. Formulations of the DFTM virus which have been used in the past must be mixed on site with a variety of components. The new formulation was designed for easier handling and mixing.

Results were that mixing and handling were much easier in the new formulations as compared to the old. However, the contractor observed that the material would begin to ferment fairly quickly after it was mixed with molasses. Report is still in preparation.



REPORT FOR WESTERN DEFOLIATORS MEETING, JULY 23, 24, 1991  
CORVALLIS, OREGON. LADD LIVINGSTON, IDAHO DEPARTMENT OF LANDS  
REPORT FOR NORTH IDAHO

Ladd Livingston

ALL DEFOLIATORS ARE AT LOW LEVELS IN NORTHERN IDAHO AT THIS TIME. NO GYPSY MOTHS WERE FOUND IN THE 1990 PHEROMONE SURVEY OF 1060 *Bacillus thuringiensis* (FORAY 48B) TREATED ACRES. SIX MOTHS WERE FOUND IN DETECTION TRAPS; THREE IN DOVER, BONNER CO., AND THREE IN IDAHO FALLS, BONNEVILLE COUNTY.

THE DOUGLAS-FIR TUSSOCK MOTH HAS BEEN SHOWING UP AT NUMEROUS SITES IN THE URBAN AREAS OF NORTH IDAHO, BUT TO DATE THERE HAS ONLY BEEN A VERY SLIGHT INCREASE IN THE PHEROMONE MONITORING TRAP CATCHES IN THE FOREST ENVIRONMENT. IN 1989, WE DID NOT CATCH ANY MOTHS IN OUR TRAPS, WHILE IN 1990 APPROXIMATELY 25-30 PERCENT OF THE TRAPS HAD SOME MOTHS IN THEM. IT APPEARS THAT WE MAY BE AT THE INITIAL STAGES OF ANOTHER POPULATION CYCLE.

THE WESTERN SPRUCE BUDWORM CONTINUES AT LOW LEVELS. DURING LOWER CROWN BEATING SURVEYS FOR THE DOUGLAS-FIR TUSSOCK MOTH WE CONSISTENTLY FIND WSBW IN THE LOW ELEVATION FORESTED AREAS EAST OF MOSCOW AND PLUMMER, IDAHO. DESPITE THIS PERSISTENT POPULATION, THERE HAVE NEVER BEEN HIGH ENOUGH NUMBERS TO CAUSE VISIBLE DEFOLIATION.

A LARCH LOOPER, IDENTIFICATION PENDING, CAUSED 6400 ACRES OF DEFOLIATION AT THREE SCATTERED SITES IN NORTHERN IDAHO. MOST OF THE DEFOLIATION, APPROXIMATELY 6300 ACRES, OCCURRED ON CRYSTAL PEAK, BENEWAH AND SHOSHONE COUNTIES. THE INSECT APPARENTLY HAS NOT PERSISTED INTO 1991.

REPORT to: Western Defoliators Steering Committee Meeting  
July 23-24, 1991  
Corvallis, Oregon  
Pat Shea, PSW

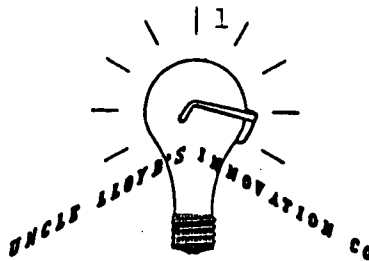
For the past several years the committee (Pat Shea was the committee's representative) has explored the possibility of developing a reliable ELISA (Enzyme linked immunosorbent assay) for the HD-1 B.t. If this assay were available the Forest Service would have a method for rapid assaying the potency of the various B.t. formulations they purchased. Discussions with representatives of NOVO and Dr. Bruce Hammock (University of California, Davis) about developing a B.t. ELISA have not been encouraging. Separate ELISA's would be required for each formulation e.g. Abbott, NOVO, Sandoz, etc.

Recently another approach to solving the quality control problem has surfaced. Lloyd Browne, a private entrepreneur, has developed a rapid and reliable laboratory bioassay that could be used as a quality control measure. The procedures he uses are based on B.t. bioassay protocols agreed upon by industry and USDA personnel at a meeting in Dalmadge's laboratory in Brownsville, TX. The advantage of the Browne bioassay is that the Forest Service can obtain results in a few days as opposed to weeks or months when relying on Dalmadge's laboratory. The other advantage is that any B.t. formulation can be bioassayed whereas several ELISA's were going to be required to cover the potentially broad array of formulations that may be encountered in the bidding process.

It is P.Shea's understanding that the Provinces of Quebec and New Brunswick have used a similar private Canadian laboratory this year to assay potency of their purchased B.t. formulations.

There is great potential in the Browne bioassay service and it should be able to provide us the quality control device that has been lacking to date. Gary Daterman will discuss this with Beckwith and formulate several B.t. standards that can be used to check Browne's capabilities. This needs to be done soon if this service is to be made available to the Regions by next field season.

LLOYD E. BROWNE  
3555 Timberlane Drive  
Easton, Pennsylvania 18042



Phone (215) 250-0946  
Fax (215) 250-7078

June 24, 1991

Dr. Patrick Shea  
Principal Research Entomologist  
USDA Forest Service, Suit 102  
2121 C, Second Street  
Davis, CA 95616

Dear Dr. Shea:

Thank you for your inquiry into the *Bacillus thuringiensis* (Bt) potency assay service that I offer here at the Uncle Lloyd's Company. To my knowledge the Uncle Lloyd's Co. is the only laboratory in the United States offering to contract such service. The assay service is outlined on the enclosed information sheet. The procedures I use follow those agreed upon by a group of industry and USDA personnel at a meeting in Brownsville TX, September 22, 1982 (Preliminary Report on Standardization of Lepidopterous *Bacillus thuringiensis* Bioassays). Most of the larger Bt producing companies use these procedures to adjust the potency of their product as this is the accepted procedure for determining potency in Billions of International Units per unit of Product (BIU's). BIU's are arbitrary units of toxicity assigned to a single standard preparation of Bt (HD-1 1980-S). The assay compares the ratio of *Trichoplusia ni* larva killed per unit weight (LD<sub>50</sub>) by the sample to those killed by the standard. This assay is reliable so long as the assay insects are healthy, the assay protocols are rigorously followed, and only HD-1 strains are compared.

Presently, the health of my *T. ni* colony is outstanding. Two problems constantly plague laboratory colonies of *T. ni*. One; a black mold occurs when the humidity is not controlled. Two; most *T. ni* colonies have a rickettsia present that may show itself under crowded or otherwise stressful conditions. I have implemented procedures that appear to have alleviate the pathogenicity of both agents (at least for now). In regard to the assay procedures, I have obtained the minutes to the Brownsville meeting and I try to follow these as close as possible. However, I do not know how closely the Bt producers are following them but of the products I have tested thus far I get good agreement with the label claims. These assay protocols, while good, probably can be improved, at least from a statistical standpoint, and I am working to do just that. Strains other than HD-1 can be evaluated by assay but to do so would require establishing some agreed-upon standard preparation for the strain tested. If the Forest Service wishes to work with other strains of Bt then I would request standards from the manufacturer.

You inquired as to whether or not I plan to use other methods such as chemical measurements to evaluate potency of Bt products. I would like to state again that I do not plan to adopt such techniques and I would like to take this opportunity to explain why I feel such tests are not reliable. While I am not an expert in the field of protein or immunochemistry, I did "kibitz" such efforts at Ecogen Inc. for six years. My opinions of these tests are entirely my own and do not necessarily reflect the opinions of Ecogen's management.

The single impediment to the various mono- and poly-cloned antibody/dye linked tests and the band absorption scans of electrophoretic sizing gels was that both tests require the crystal to be dissolved prior to testing. Once dissolved the toxin is very vulnerable to destruction by proteinases present in the "soup". The various fermentation media used by producers is often selected on a cost basis and differs considerably from the chemically defined media usually used in research production. Commercial media vary greatly in their proteinase content. On some media the proteinase level is so high that the toxin is "chewed up" almost as fast as it is dissolved. Apparently, isolating and washing the toxin crystal does not alleviate this problem as the proteinases can be entrained in the crystal. Perhaps a producer who has standardized their production and calibrated their test procedures with bioassay can use these chemical tests. But for someone, such as myself, who would be testing many different products of unknown compositions, such tests would not be useful.

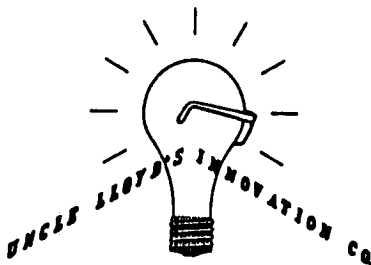
I thank you again for your interest in Uncle Lloyd's.

Sincerely,

  
Lloyd E. Browne

sheal.let

LLOYD E. BROWNE  
3555 Timberlane Drive  
Easton, Pennsylvania 18042



Phone (215) 250-0946  
Fax (215) 250-7078

**ATTENTION**  
**MANUFACTURERS, EXPERIMENTERS, AND**  
**USERS**  
**of**  
***Bacillus thuringiensis (B.t.)* INSECTICIDES**

UNCLE LLOYD'S INNOVATION COMPANY is now offering an assay service to determine the potency [in International Units per milligram of Sample (IU's) or in Billions of International Units per pound (BIU's)] of your B.t. products.

**ASSAY PROTOCOLS:** The potency of your product is estimated by comparing it's toxicity to cabbage looper with that of a standard B.t. product of known potency. Two treatments, your Sample B.t. and the Standard B.t. are incorporated into BioServ<sup>TM</sup> Cabbage looper diet on a weight per volume basis. Each treatment is diluted 2:3 in a series of eight dilutions plus an untreated control. Each dilution is tested using fifty, individually caged, 4-day-old cabbage looper larva (*Trichoplusia ni*) per replication. This test is replicated on three different days. Mortality counts are made after four days of feeding on the treated diets. LD<sub>50</sub> of each treatment replication is estimated using probit analysis.

**RELIABILITY:** The assay is considered reliable when the calculated LD<sub>50</sub> lies between the middle six doses tested and the potency estimates of the three replications display a coefficient of variation less than 20%.

**SERVICE:** The assay requires a minimum of seven days for it's completion. However, for the fastest possible service, we recommend the customer give us a notification seven days prior to sample shipment. When requested, the results will be transmitted by phone or FAX. Raw data is shipped by U S Mail.

**COST:** \$450 per sample

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UNCLE LLOYD'S INNOVATION COMPANY is a privately owned laboratory which conducts insect assays and research in insect behavior. The director of research, Lloyd E. Browne, has over 30 years of experience in entomological research including experience in both universities and private industry.

REPORT to: Western Defoliators Steering Committee Meeting  
23-24 July, 1991  
Corvallis, Oregon  
L.E. Stipe R1

Larry Stipe

#### Western Spruce Budworm

During a major storm in January 1989, cold temperatures caused heavy winter damage to most tree species and a large SBW population decline. Hardest hit here those areas along and near the continental divide. Tree damage ranged from minor to severe with some tree mortality. Trees continue to die to the present. In 1990 the SBW population started to rebound, but was set back again during December 1990 by another cold snap. This years damage was mostly in Douglas-fir and is mostly bud mortality. No tree mortality is expected this year. Although we do not know the full effect on the SBW population trend, it will most likely take another year or two to reach the pre 1989 levels. As a result we continue to monitor the situation with hopes R1 can provide a suitable project site that could be used to further the objectives of this committee.

Two years ago our monitoring was expanded to include SBW pheromone traps. By this Fall we will have a paired set of trap and population data for three years at three sites. We are hoping to then focus on traps to provide trend information and eliminate the more labor intensive sampling we've done in the past.

#### Douglas-fir Tussock Moth

Trap counts for 1989 were near zero. In 1990 our total catch went up to about 30 overall, but no visible defoliation yet. To the West and South outbreak conditions were back. We have increased our trapping efforts this year in hopes we don't miss a population increase likes those to the West and South.

#### Gypsy Moth

Our trapping efforts were increased five fold during 1990 to include most urban areas of the Region. This effort continued again 1991. Six moths were caught in 1990, most were singles. No results so far this year. Stay tuned.

#### Projects

No aerial application projects (oppperational, pilot, or field) were conducted in 1990, and none are planned for 1991 nor do we anticipate any for 1992.

Julie Weatherby

NATIONAL STEERING COMMITTEE FOR APPLICATION OF PESTICIDES - WESTERN DEFOLIATORS  
CORVALLIS, OREGON  
JULY 23-24, 1991

REPORT FROM REGION 4

Current Defoliator Outbreaks:

Douglas-fir tussock moth - Over 40,000 acres of defoliation were mapped in 1990; however populations and visible defoliation are much more widespread. At least one area of heavy infestation has been detected on the Wasatch Cache NF in Utah. Several other areas of heavy defoliation have been detected on the Boise and Payette NFs in southern Idaho.

Western spruce budworm - Acres of visible defoliation have increased from 11,000 acres in 1989 to 43,000 acres in 1990. The Salmon NF is the most heavily infested area. It appears that the population may be on the increase throughout southern Idaho.

Gypsy moth - No defoliation from gypsy moth has been detected within R4. Gypsy moths were trapped in two areas in Idaho; one in northern Idaho and one in Idaho Falls in 1990. Mass trapping is being used to eradicate populations in these areas. In Utah trapping efforts continue to detect populations along the Wasatch Front.

Suppression and Eradication Efforts:

Douglas-fir tussock moth - A field test of two different rates of DFTM is nearing completion. The test areas is located near Featherville, Idaho. Roy Beckwith, PNW, is project director. Twenty-one day post treatment samples will begin on August 2, 1991.

A pilot test of the mating disruption strategy will be installed near Weiser, Idaho probably in mid to late August. Three 200-acre blocks will be treated in an effort to evaluate the effectiveness of this technique for large areas. Julie Weatherby, FPM, and Lonne Sower, PNW, are in charge of this project.

No other suppression projects are planned.

Western spruce budworm - No suppression projects are planned.

Gypsy moth - Approximately 27,000 acres were sprayed three times with B.t. in infested areas along the Wasatch Front. Pheromone traps will be used to determine the effectiveness of the treatment.

Suggestions for Future Special Projects

- \* Additional information on impacts caused by biological insecticides on non-target organisms.
- \* Impacts of defoliators upon other resources, i.e. recreation, watersheds, wildlife, soils, etc.

- \* Workshop on developing Benefit:Cost ratios for various direct suppression alternatives on timber and other resource values.
- \* Improvement of the DFTM early warning system.
- \* Improved hazard ratings for defoliators.
- \* Improvements in application technology for aerial pheromone applications (i.e. pheromone flakes, fibers, pellets)



WESTERN DEFOLIATOR STEERING COMMITTEE MEETING-1991  
R5-Pacific Southwest Region Report  
John. M. Wenz

Defoliator activity in Region 5 continued at low levels in 1991, with no significant budworm, tussock moth, or fruittree leafroller damage reported. As of July 23, 1991, two adult gypsy moths had been trapped by the California Department of Food and Agriculture (CDF&A), one each in Los Angeles and Orange Counties. Increasing black pineleaf scale defoliation on ponderosa pine and feeding damage on blue oak by Chionodes sp. (Gelechiidae) was observed in northern California.

Registration of TM-Biocontrol-1 with CDF&A is still pending. Toxicological data was submitted in 1990.

Region 5 suggests, given the increasing emphasis on New Perspectives and Forest Health, that the Committee consider establishing a subcommittee to address possible interactions between defoliator-related issues and New Perspectives and look at ways to become involved New Perspectives activities. Issues include, but are not limited to; 1) Effects of uneven-age management (stand structure, species diversity and composition etc.) on western defoliators, 2) Effects/impacts of defoliators on non-timber resources (e.g., T&E species, other wildlife), 3) Development of defoliator management strategies that are responsive to different resource management goals and objectives, 4) Effects of "biological" insecticides on non-target organisms, and 5) An increasing need to address impacts/management of defoliators in the urban-forest interface.

APPENDIX B

*Jack Shuy*

## MICROBIALS AND FORESTRY - A MARKETING PERSPECTIVE

(A PRESENTATION BY A. TEMPLE BOWEN MADE ON 3/27/91  
AT THE NORTH AMERICAN FOREST INSECT WORK CONFERENCE)

### I. INTRODUCTION

What is marketing?

What it is not, is sales!

Marketing might be described as a function that deals  
with the broad, long term view of:

- Who customers are ... what are their needs.
- How do they purchase and ...
- How their needs change with time.

The corporate marketing manager is therefore challenged  
to develop a marketing plan that charts ...

- What is needed
- How to position against competition
- How to gain market share
- How to defend and increase market shares (profit)
- and ... very importantly ...
  - develop links with product
  - development so that they ....
  - and the products ... fit into
  - the market strategy.

Since one of the key challenges to marketing is  
developing a product to meet the markets needs .....

**What is that microbial product in Forestry?**

As in most natural science areas ... it depends.

Let's look at it from each of our perspectives. . . .

#### END USER

- 100% efficacious
- Innocuous except to target pest
- Long residual
- Acceptable to public
- Odorless
- Economical/affordable/good value

#### **APPLICATOR**

- Safe to the applicator and equipment
- Meets customer's minimum needs
- Can apply under adverse conditions
- Will not create damage claims
- Odorless
- Low specific gravity
- No containers to dispose of
- No callbacks

#### **CONSULTANT/ENTOMOLOGIST**

- Effective
- Consistent
- Predictable
- Easy to trace/measure on target
- Specific to target pest(s)

#### **TECH SALES REP.**

- Good value
- Flexible - several end uses
- Better than competitive product
- Easy to ship and store
- High value per unit volume
- Trouble free application

#### **Finally ...the Marketing Manager wants ...**

- Large, consistent market (demand)
- Increasing (or growing) demand
- Year round (non-seasonal) market
- Reasonable logistics - from mfg. to forest
- Future growth opportunities good
- High profit margins
- Unique and/or little competition
- Easy and quick to register . . . .

and meets everybody else's needs,

**So - let's do a little role playing.**

Imagine, if you will, you are the Marketing Manager (hereafter M&M) and your CEO has just called you and said - let's meet next week .. M&M ... and discuss the opportunities for us to expand into this Forestry microbials market.

Outstanding, Chief, I will look into it and report my findings.

So... you call in "old ATB" and say to him ... I need to know what is it with this forestry market. What's going on in the trenches?

1. M&M: How big is the market?

ATB: This year or last?

M&M: Why?

ATB: - Since 1980, market has grown significantly  
- Annual variation 100% (\$7-\$15 MM/NA)  
- Rest of world negligible  
- Depends upon ....

- ⌘ insect epidemics/outbreaks
- ⌘ politics
- ⌘ public funding/budgets
- ⌘ public opinion on alternatives

...all of which we don't control

2. M&M: What is the price?

ATB: This year or last?

M&M: Why?

ATB: - Since 1978 range = \$1.00 - 0.20/BIU  
- Since 1985 range = \$0.40 - 0.20/BIU  
- Going down  
- Depends upon

- ⌘ market size
- ⌘ timing of sales
- ⌘ type of sales
- ⌘ number of players
- ⌘ availability of product

3. M&M: Fine. How about future expansion?

ATB: Long term r.o.w. looks good.

- NA, short term depends on loss of chemical option on 1 MM acres +/- then B.t. has it all

4. M&M: Who are the players?

ATB: What is a player?

M&M: - consistent  
- long term commitment  
- full service tech repping (field support)

- product/field development

ATB: - Looks like 2 right now  
- Many in the wings

5. M&M: How about ease/speed of entry

ATB: You just heard an excellent analysis of the regulatory situation

- easier/cheaper than chemicals  
- 3 years for full participation

6. M&M: What is the ideal product?

ATB: Good question, boss... again it depends

⌘ For g.m.? sbw?  
⌘ Aerial or ground?  
⌘ U.S. or Canada  
⌘ Oil or water based  
⌘ Potency? 48B - 125/U.S. gallon

7. M&M: How is choice of product made?

ATB: - Acceptance (eligibility) by perceived performance  
- Real data/performance not req'd. in U.S.  
- Like real estate on buying price.....price.....price

8. M&M: - How much commercial field development necessary/expected?

ATB: - Major annual investment (6 figures)  
- Required in Canada for registration  
- Much is aerial spray technology  
- Results generic/not proprietary

So ... my M&M ... assuming ATB has been accurate ... here's your brief report to the CEO.

Listen to this ...Chief. What a great opportunity!

⌘ The market varies from \$7-15 MM but can change 100% year to year

⌘ Since 1978 price have dropped 5 fold from 1.00/BIU to 0.20/BIU

⌘ Major short term growth will depend, in NA, on dropping chemical options, then B.t. has 100%

⌘ Several potential players in the wings

- ⌘ It will take 3 years to really get into the marketplace.
- ⌘ One product will not suffice
- ⌘ Purchasing primarily by price
- ⌘ Annual development over \$100,000 and results are B.t. generic, publicly presented not proprietary

Now .... You make up your mind how attractive this picture would be to your corporate CEO.

But ... more importantly ... and why we are here - What can you folks do about this? As end users, consultants, administrators, are there things you can do to enhance corporate interest in entering this market, participating in it and developing specific forestry microbial products to meet your needs?

The answer is a definite .... you betcha!

How? How can you influence manufacturers to ...

- Enter/continue in the market
- Produce superior performing products
- Design specific products for forestry
- Continue to support better spray technology

Here are some of my suggestions ...

- ⌘ Set up long-term (multi-year) contracts (commitment)
- ⌘ Start selecting product based on performance/value .... rather than lowest cost/BIU (Analogy: from Tom's luncheon talk .... Bungee-jumpers! How many of you would put your bungee cord purchase out to the lowest bid?)
- ⌘ Provide greater public support ... not only dollars but staffing and leadership ... on generic public issues such as:
  - Aerial spray technology
  - Deposit analysis
  - Equipment development
  - B.t./insect biointerface etc.
- ⌘ Develop creative contracting with manufacturers
  - Aerial applicators to develop specific strategies for specific situations.

- ⌘ Make earlier commitments for product and reduced time between offers and awards (...this one is critical for applicators as well)
- ⌘ Modified regulatory policies and practices that would allow more rapid introduction of product improvements where minor changes are involved.
- ⌘ Complete and timely reporting of field and laboratory tests
- ⌘ Large public purchases made directly from manufacturers and avoid applicator as a middleman.

Well, I was asked to provide food for thought ... and sow seeds for discussion. I hope I have succeeded. Thank you.

#### DISCUSSION



APPENDIX C

FORESTRY CANADA  
Pacific Forestry Centre

Proposed CR No: !  
Created: 22-Aug-1991 09:52am PST  
Sent: PST  
From: Imre Otvos  
IOTVOS  
Dept: Research  
Tel No: 363 0600

*Jack Smiley*  
TO: R. (Bob) DeBoo ( RDEBOO )  
Subject: TREATMENTS AGAINST FOREST INSECTS IN B.C. IN 1991

Bob,

Finally, I managed to come up with the information on all three insects.

1. Douglas-fir tussock moth: three virus treatments were applied to a total of 200ha

- a) Fresh Virtuss: 60ha, 12.5g/ha, at the rate of  $2.5 \times 10^{11}$   
(produced during the fall/winter of 1990/91)
- b) Old Virtuss : 100ha 25.0g/ha, at the rate of  $2.5 \times 10^{11}$   
(produced at FPMI, stored recently by BCFS in Victoria)
- c) Old TM-Biocontrol-1: 40/ha, 7.0g/ha, at the rate of  $1.3 \times 10^{11}$   
(produced by the USFS stored by BCFS in Victoria)

All three virus products were applied at the rate of 10L/ha containing 25% food-grade molasses, 6% Orzan (to protect the virus from UV) and the rest water (aerated for 24 hrs to get rid off chlorine).

2. Western spruce budworm:

3,000ha treated with Dipel 132 at 30 BIU/ha once in 2.4L/ha.

3. Eastern spruce budworm:

536ha treated twice with Dipel 132 at 30 BIU/ha (later check by Abbott showed 28.5 BIU/ha) in 2.4L/ha. First application was at 3rd-4th instars second application when larvae were in 4th-5th instars.

Hope this is the information you were looking for.

Have a good and safe trip and a Good Holiday.

Adieu,

*Imre* \* B.t. also used by Aglanoda vs gypsy moth @ Victoria in 1991. Area treated was ca. 150 ha; 3x helicopter applications; product was FORAY; area was private urban forest. 480 @ 40 BIU/ha